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Tetranychidae of Connecticut

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Tetranychidae of Connecticut

PHILIP GARMAN

THE Tetranychidae or red spiders, as they are frequently called, form a rather small group of the Class Acarina, Order Prostigmata. However, in view of the importance of these mites as plant feeders, and the amount of damage done throughout the State to agricultural crops, it has seemed desirable to draw up a list of the species commonly encountered, together with characters and keys for identification.

The family Tetranychidae includes those mites in which the chelicerae are needle-like and covered at the base by a mandibular plate; the eyes are often recognizable on the cephalothorax as red spots; the tarsal appendages are provided with peculiar tenent hairs, each of which has a transverse hook at the tip; and the collar tracheae are present beneath the mandibular plate.

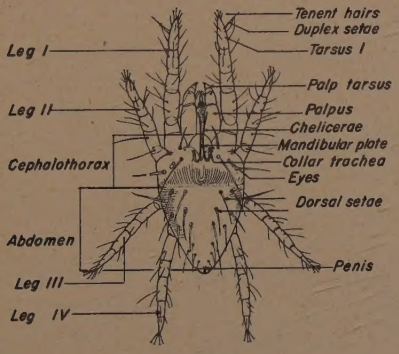

FIGURE 1. Semi-diagramatic figure of a male of the Tetranychidae showing location of parts used in the descriptions.

Of the characters for identification, those of most value consist of the collar tracheae, the claws, and the male genitalia. Besides these, considerable use is made of the palp tibia and tarsus, the length of the leg segments, and the size and nature of attachment of the dorsal setae of the abdomen. The egg is also of considerable importance because of its color and shape. In addition some use is made in this paper of the double setae on the front tarsi. These "duplex" setae (Figs. 1, 14) consist of one long and one short seta and are variable in arrangement and number.

The life stages consist of egg, larva (provided with three pairs of legs instead of four), two nymphal stages resembling the adult, and the adult. The winter may be passed as either egg or adult and there are probably several generations a year for most species. Red spiders are able to pierce the

leaf tissues with their sharp mandibles and chelicerae and destroy the chlorophyll. In severe infestations the leaf may then turn yellow or brown or drop from the plant prematurely. Continued heavy infestations of annuals may destroy them. The common type of injury is shown in Figures 2, 3, and 4.

Controls usually employed are sprays of oils, glues, derris or cubé extracts, sulfur in spray or dust, and syringing with a forcible stream of plain water. Fumigations with naphthalene or a combination of naphthalene and paradichlorobenzene are often successful under greenhouse conditions. The merits of the different treatments will not be discussed here.

FIGURE 2. Injury to bean leaf by greenhouse red spider.

Key to Genera

1. Front margin of the cephalothorax projecting in the form of lobes; body conspicuously flattened; front legs with a constriction at base 2
   Front margin of the cephalothorax not projecting in the form of lobes; body not conspicuously flattened; front legs without a constriction at base..... 3
2. Legs wrinkled transversely; cuticle of dorsum distinctly areolate; small, short-legged species, rather sluggish.....**Tenuipalpus p.** 71
   Legs not wrinkled transversely; projecting lobes on the cephalothorax with scales; cuticle of dorsum not areolate but rugose; large, long-legged species, fairly active .....**Bryobia p.** 69
3. Claw of tarsus I of female with at least 9 fine setae on either side beneath; no duplex setae visible on tarsus I; legs of adult female twice as long as the body .....**Tetranychina p.** 73

Claw of leg I of female, when present, without the fine setae mentioned above; one or two duplex setae visible on tarsus I; legs always less than twice as long as the body 4

4. Only one duplex seta on tarsus I; claw reduced and very small, not attached to the tip of tarsus ..... **Neotetranychus p.** 73

Two duplex setae on tarsus I; claw either large and distinct or absent; when present attached to the tip of the tarsus 5

5. Tarsi of females without empodial claws; collar tracheae hooked at end ..... **Tetranychus p.** 80

Tarsi of females with empodial claws; collar tracheae not usually hooked at end. 6

6. Empodial claws bifurcate, no appendiculate hairs present ..... **Schizotetranychus p.** 74

Empodial claws entire, appendiculate hairs present ..... **Paratetranychus p.** 75

THE following notes on the different species contain, in addition to the condensed description, some of the synonyms, the place of the original description, and references to available ones in English, preferably published in the United States. Drawings serve to clarify descriptions. Several species are described as new. The possibility of making further synonyms has been carefully considered, but the new forms do not seem to coincide fully with those already known, so it appears advisable to risk new names.

Illustrations are original except where otherwise credited.

The species are arranged in a phylogenetic system, supposedly from lowest to highest degree of specialization, but arrangement within the analytical keys does not necessarily correspond.

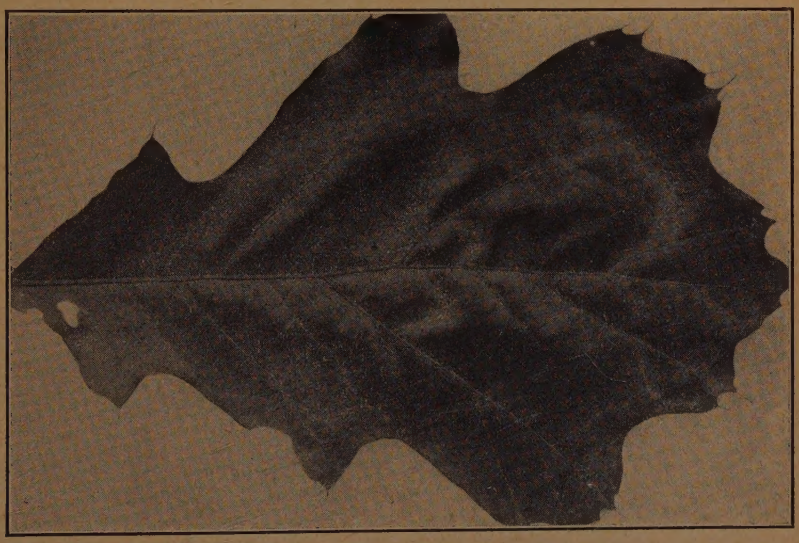

FIGURE 3. Injury to oak leaf by the oak mite, *P. bicolor* Banks. Photo by B. H. Walden.

Bryobia praetiosa Koch (Figures 5, 17B)

Koch, C. L., Deutschlands Crustaceen, Myriapoden u. Arachniden 1835–1844 (H.1. n.8)

Garman, H., (*B. pratensis*), 14th Rept. State Ent. Illinois, pp. 73-4, pl. VI, 7. 1885.

Riley, C. V. and Marlatt, C. L., Insect Life III, pp. 45-52. 1890.

Ewing, H. E., Proc. U. S. Nat. Mus., 59: pp. 661-662. 1921.

Webster, F. L., U. S. Dept. Agr. Circ. 158. 1912.

FIGURE 4. Injury to peach leaf by the European red mite, *P. pilosus* C. & F. A. Infested leaf. B. Uninfested leaf. Photo by B. H. Walden.

Eggs: Uniform red, without striations.

Larvae: Bright red on emergence in spring.

Nymphs: Brown, similar in general appearance to the adults, but paler in color.

Adults: Dark brown to almost black, often with a greenish tinge. Dorsum depressed and coarsely wrinkled. Anterior margin of cephalothorax with four projections, each bearing a flat scale (Fig. 5f). Tarsi long, with two claws, six tenent hairs on leg I, and a conspicuous setose empodium between the claws of the running legs. Collar tracheae much expanded at tips as shown in Fig. 5c. Palp tarsus with four heavy and three slender setae on terminal segment, the hook of the tibia strong and sharply curved (Fig. 5e), extending to the tip of the palpus. Dorsal scales of the abdomen; eight along each lateral margin, six in center. Cephalothorax with two scales on each side, one in front and one behind the double eyes.

Measurements: Adult female .80 to .95 mm. by about .6 mm. in width; egg .19 mm. in diameter.

Host plants: This species, known as the "clover mite", is commonly encountered on clover and grasses in lawns and causes inconvenience to housekeepers by seeking hibernation quarters indoors. It also appears in spring after hatching of winter eggs, sometimes congregating on window sills and walls.

Tenuipalpus bioculatus McGregor (Figure 6)

McGregor, E. A., Ann. Ent. Soc. Amer., VII: pp. 354–360, pl. XLII, 1914. Jour. Econ. Ent., Vol. 9: pp. 556–561, 1916.

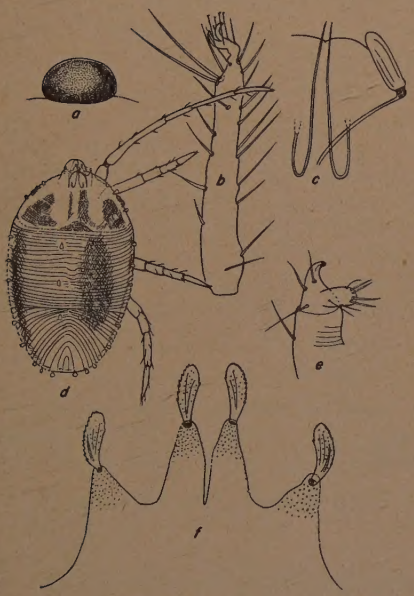

FIGURE 5. *Bryobia praetiosa* Koch. **a.** Egg. **b.** Tarsus I. **c.** Collar trachea. **d.** Adult female in dorsal view. **e.** Tip of palpus. **f.** Cephalothoracic projections with scales.

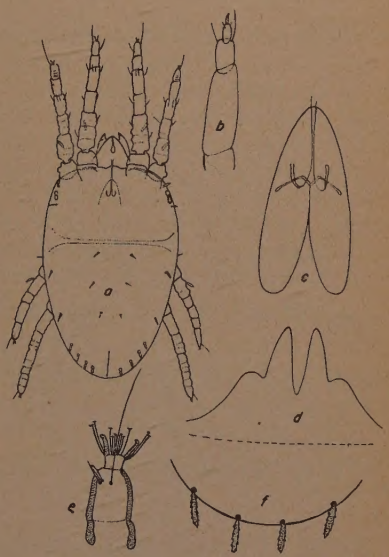

FIGURE 6. *Tenuipalpus bioculatus* McG. **a.** Adult female in dorsal view. **b.** Palpus. **c.** Mandibular plate showing chelicerae and collar tracheae. **d.** Cephalothoracic projections. **e.** Tarsus I. **f.** Caudal margin of nymph.

Eggs: Reddish orange, elliptical in outline.

Larvae and nymphs: Similar in general appearance to the adult, but frequently lacking the reddish color of the latter, and with larger setae on the caudal margin.

Adult: *Male and female*—Both male and female are much flattened. Their legs are short, hardly extending beyond the caudal end of the abdomen. Color sometimes pale or nearly hyaline, more often with a pinkish or reddish orange color. Legs peculiar in form, being transversely wrinkled, the front legs with a definite constriction at base; two tarsal claws on each. Cephalothorax projecting in rounded or sharpened lobes, but these are

without spines or scales. Mandibular plate (Fig. 6c) more sharply pointed than in most other Tetranychidae, the collar trachea slender and very difficult to see but provided with an enlarged, somewhat elliptical chamber at end. Dorsum of abdomen with short, wide, coarsely toothed spines on the caudal margins and dorsal surface, difficult to distinguish because of the corrugated surface. Skin of venter distinctly areolate between the legs and with two rather definite plates.

FIGURE 7. *Tetranychina harti* Ewing.
a. Thorax and abdomen in lateral view. **b.** Collar trachea. **c.** Labial palpus. **d.** Spine from dorsum, greatly enlarged. **e.** Tarsus I. **f.** Penis. **g.** Egg in lateral view.

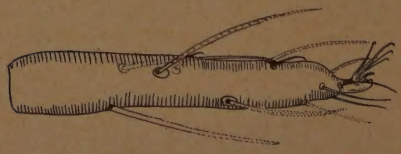

FIGURE 8. Tarsus of *Neotetranychus buxi* R. & G.

Measurements: Adult female .30 to .33 mm. by .15 to .17 mm.; male .24 by .12 mm.; egg .09 by .06 mm.

Host plants: Taken from elderberry, *Sambucus*, and Joe-pye-weed, *Eupatorium*. Reported by McGregor to be a pest of privet in South Carolina.

Collections: Hamden, September 21, 1922; Cheshire, September 1, 1939; Southington, September 3, 1939.

The damage to the host appears as a sort of reddening of the foliage.

Tetranychina harti Ewing (Figures 7, 11)

Ewing, H. E. (*Neophyllobius harti*), Trans. Am. Ent. Soc., XXXV: pp. 405–6, pl. XIV. 1909.

Eggs: Dark red, smooth without definite striations, flattened below where they rest in contact with the leaf.

Larvae and **nymphs:** Dark red in color, the legs and spines much shorter than the adult.

Adult: *Female*—Color dark red, with legs twice as long as the body, resembling a phalangid. Dorsal spines coarsely feathered and set on tubercles (Fig. 7a). Tarsi at tips marked with peculiar dashes instead of the usual striations, the claw of leg I provided with about nine fine setae below on each side, tenent hairs on conspicuous stalks. Collar tracheae with an expanded end chamber as in Fig. 7b. Palp tibia with a strong hook, tarsus a short sense hair (spatulate), several (six) stout spines and broad terminal finger. Mandibular plate covered at tip with very short spines. *Male*—Color similar to the female, the legs proportionately longer, about three times as long as the body. Penis nearly straight, sharply pointed at tip.

Measurements: Female .64 to .66 mm. by .44 mm.; male smaller, .25 to .33 mm. by .15 mm.; egg .126 to .13 mm.

Hosts: Collected from Oxalis at the following locations: New Haven, June 30, 1922; Hamden, July 16, and August 24, 1939. Causes a fine stippling to appear on the leaves which sometimes turn almost white.

A species easily distinguished by its long legs, tuberculate spines and other features.

Neotetranychus buxi Ries & Garman (Figure 8)

Ries, D. T., and Garman, P., Jour. Econ. Ent., 24: pp. 55-62. 1935.

Eggs: Lemon yellow and covered with shallow yet distinct sculpturing extending in ridges from base to center of the top; distinctly flattened on top and bottom; light yellow when first laid, with a number of dark circles visible just under the chorion.

Adults: *Female*—Green to yellowish brown. Tarsus long and slender (Fig. 8), the claw small and much reduced, without appendiculate hair; only one pair of duplex setae visible. Collar trachea slender, without enlargement at tip. Palp tarsus with pointed terminal finger and apparently without dorsal sense organ; hook, large and heavy. Middorsal setae of the abdomen, short, feathered, not as long as the intervals between. *Male*—Similar in color to female. Penis gradually curved, sharply pointed at tip.

Measurements: Adult female .50 to .56 mm. by .35 mm.; male .43 by .22 mm.; egg .15 to .20 mm. in diameter.

Hosts in Connecticut: The only plant on which this species has been found is ornamental boxwood or *Buxus*. Saugatuck, August 28, 1936.

Genus **Schizotetranychus** Zacher

THIS genus was erected to include species with bifurcate empodial claw. The eggs of our species are decidedly flattened and with a central papilla.

Key to Species

1. Last three segments of leg I approximately equal in length; terminal chamber of the collar trachea elongate. Tarsus of leg I suddenly constricted beyond the duplex setae ..... **spireafolia p.** 74

   Last three segments of leg I unequal, the proximal one of the three much shorter. Collar trachea with a relatively shorter terminal chamber. Tarsus of leg I gradually tapering beyond the duplex setae ..... **schizopus p.** 75

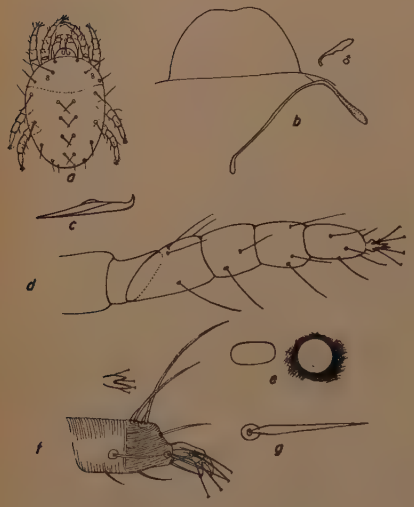

FIGURE 9. *Schizotetranychus spireafolia* n. sp. **a.** Dorsal view. **b.** Collar trachea. **c.** Penis. **d.** Leg I, greatly enlarged. **e.** Egg in dorsal view and lateral profile. **f.** Tarsus with tarsal claw from below. **g.** Dorsal seta, enlarged.

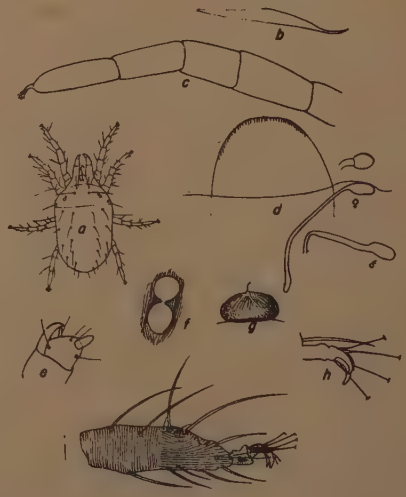

FIGURE 10. *Schizotetranychus schizopus* Zacher. **a.** Adult female in dorsal view. **b.** Penis. **c.** Leg I. **d.** Collar trachea. **e.** Palp tarsus. **f.** Eyes. **g.** Egg in lateral view. **h.** Tarsal claws. **i.** Tarsus I.

Schizotetranychus spireafolia n. sp. (Figure 9)

Egg: Milky white, pearl-like; circular in outline viewed from above, elliptical in lateral profile; covered with a rather dense web by the female under which the earlier stages live for protection.

Larvae and **nymphs:** Similar in general appearance to the adults.

Adults: *Female*—White to yellowish with obscure darker spots and conspicuous carmine eye spots. Body depressed or flattened, the legs short, hardly as long as the body width. Tarsi short, with divided claws, one arm

of each claw appearing shorter in many slides because of its position; duplex setae closely approximate at base. Collar tracheae slender, the terminal chamber elongate, elliptical, Fig. 9b. Palp tarsus with a very strong hook extending to the base of the terminal finger. Dorsal setae of the abdomen of the usual number but very short and without conspicuous feathering, hardly as long as the intervals between their bases. *Male*—Similar in color to the female but smaller. Penis with a sharply curved point, without hook or barb.

Measurements: Adult female .31 to .36 mm. by .26 to .27 mm.; male .27 mm. by .15 to .18 mm.; egg .11 mm. in transverse diameter.

Host plants: Found abundantly on *Spirea latifolia.*

Localities: New Haven, August 20, 1934, J. F. T.; Hamden, August 27, 1939; Bethlehem, August 28, 1939. P. G.

Types: In collection of the Connecticut Agricultural Experiment Station.

Schizotetranychus schizopus Zacher (Figure 10)

Zacher, F., Mitt. Kais, Biol. Anst. F. Land-und Forst, Heft. 9, p. 40, 1910.

Eggs: Summer eggs light brown, striated above and with a very short central papilla, Fig. 10g.

Larvae and **nymphs:** Similar to adults in color.

Adult: *Female*—Light brown to yellow in front, to reddish yellow behind, variable. Tarsus I with approximate duplex setae, the tarsal segment itself about one-fourth longer than the preceding segment, Fig. 10c; third segment from the end shorter than the last two. Empodial claws deeply bifurcate. Tarsus I with a slender seta or bristle above each fork. Palp tarsus with the usual terminal finger and setae; tibial claw not extending to the terminal finger but reaching beyond the dorsal sense organ. Dorsal setae of the abdomen longer than the interval between their bases. *Male*—Yellowish to whitish yellow or reddish orange. Penis slender, almost straight, not curved or hooked but with a long, slender tip.

Measurements: Adult female .33 to .41 mm. by .17 mm.; egg about .08 mm. in greatest diameter.

Hosts: This species has been taken from several willows (*Salix*) in Hamden and Yalesville.

Collections: Hamden, August 27, 1923; August 20, 1939; August 20, 1920.

Genus **Paratetranychus** Zacher

FOUR species occur in Connecticut. Their principal character in common lies in the possession of a simple empodial claw with appendiculate setae at or near the base. The collar tracheae are never conspicuously hooked as in Tetranychus; the eggs are dark colored without exception and provided with a central papilla.

Reference: McGregor, E. A., Proc. U. S. Nat. Mus., **56**: pp. 665–677. 1919.

FIGURE 11. *Tetranychina harti* Ewing. Adult female.

FIGURE 12. A. *T. ludeni* Zacher. B. *Paratetranychus ununguis* Jacobi. C. *Paratetranychus pilosus* C. & F.

Key to Species

1. Adult females dark velvety red with white or pale spots at the base of the dorsal setae, appendiculate hairs of the empodial claw attached well beyond the base of the claw ..... **pilosus p.** 77
   Adult female with black or brown abdomen, without pale areas at the base of the dorsal setae (except in **ilicis**), appendiculate hairs of the empodial claw at or near the base 2
2. Collar of adult female pinkish or rose color; dorsal setae on distinct tubercles ..... **ilicis p.** 78
   Collar of adult female never pink or rose color; dorsal setae not on distinct tubercles 3
3. Largely oak feeding species; eggs with a decided flattened area on top that is smooth and free of striations Fig. 14c..... **bicolor p.** 77
   Inhabiting conifers of various sorts; eggs without a flattened area on top ..... **ununguis p.** 80

Paratetranychus pilosus C. & F. (Figures 12C, 13)

Canestrini & Fanzago, Intorno agli Acari Italiana, Atti Ist. Venet, Ser. 5, Vol. 4: pp. 69-208. 1877–78.
McGregor, E. A., Proc. U. S. Nat. Mus., **56**: p. 671. 1919.

Eggs: Summer eggs brown; winter eggs red; decidedly flattened, striate and with a central papilla or hair.

Larvae: Orange to bright red.

Nymphs: Greenish or brown, darker on sides, the legs pale.

Adults: *Female*—Dull velvety red with tubercles on which the dorsal setae are borne, appearing as white spots on dorsum of abdomen. Tarsi with heavy claws, the six appendiculate hairs attached to about the basal third. Duplex setae only slightly separated, the longer setae of the two groups unequal in length. Palp tibia with strong hook reaching much beyond the dorsal sense organ of the tarsus. Middorsal setae long and feathered, much longer than the intervals between. Collar tracheae slender and with an almost spherical chamber at the end. *Male*—Color much lighter than the female, usually brown; penis gently curved, short and not hooked or barbed, Fig. 13g.

Measurements: Adult female .38 to .40 mm. in length by .21 to .26 mm.; male .26 to .28 mm. in length by .15 mm. in width; eggs .12 to .15 mm. in greatest diameter.

Hosts: Rose, pear, peach, plum, cherry, apple, elm and mountain ash. Very common and widely distributed throughout the State. Severe infestations may cause the entire foliage of an orchard to turn brown, and in dry seasons cause considerable leaf drop.

Location: Found in all localities wherever apples are grown, and known as the "European red mite". Collections from practically all parts of the State.

Paratetranychus bicolor Banks (Figure 14)

Banks, N., Trans. Am. Ent. Soc., XXI: p. 218. 1894.
McGregor, E. A., Proc. U. S. Nat. Mus., **56**: pp. 675–676. 1919.

Eggs: Brown, with a conspicuous flattened area on top and dorsal seta which may be indistinct or wanting; striations distinct on sides of egg.

Larvae and **nymphs:** Similar in color to the adult.

Adults: *Female*—Abdomen dark green to black with a paler mid-dorsal stripe, collar, consisting of cephalothorax and part of abdomen, flesh color to brown. Tarsi with a very long claw and appendiculate setae very near the base. Duplex setae approximate, as shown in Fig. 14e. Dorsum with slender setae not set on tubercles, each one reaching beyond the base of the setae immediately behind. Collar tracheae slender with an ovoid to spherical end chamber, Fig. 14b. *Male*—Similar to the female in color, the penis with a bluntly curved end hook, Fig. 14d, not sharply upturned.

Measurements: Adult female .39 to .42 mm. by .21 mm.; male .35 mm. by .16 mm.; eggs .13 mm.

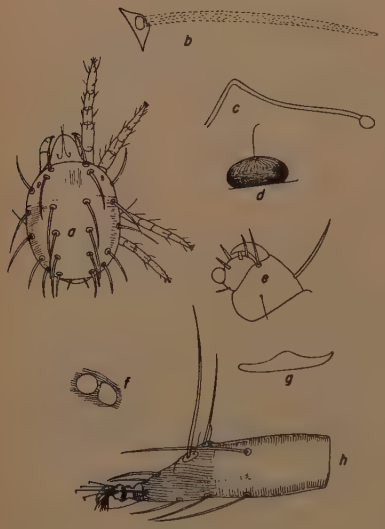

FIGURE 13. *Paratetranychus pilosus* C. & F. **a.** Adult female, dorsal view. **b.** Dorsal spine. **c.** Collar trachea. **d.** Egg in lateral view. **e.** Palp tarsus. **f.** Eyes. **g.** Penis. **h.** Tarsus I.

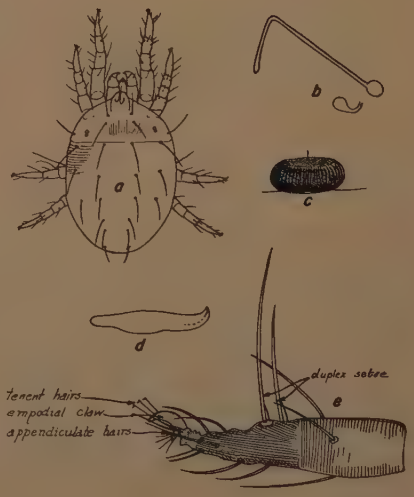

FIGURE 14. *Paratetranychus bicolor* Banks. **a.** Adult female in dorsal view. **b.** Collar trachea. **c.** Egg in lateral view. **d.** Penis. **e.** Tarsus I.

Host plants: Collections throughout the State on oak, maple and hickory; the "oak mite".

Paratetranychus ilicis McGregor (Figure 15)

McGregor, E. A., Proc. U. S. Nat. Mus., **51:** pp. 586–588, pl. 106. 1917.

Egg: Brown to reddish, depressed and with a long central papilla more than equal the height of the egg; without a distinct flattened area above.

Larva: Nearly white with a few reddish dots.

Nymphs: Similar to the adults but without pink or reddish coloration.

Adults: *Female*—Abdomen dark brown, the collar including the cephalothorax pinkish or red in color. Tarsi with a long claw, the appendiculate hairs attached close to the base and well separated from one another; duplex setae approximate. Collar tracheae slender with an oval or elliptical chamber at end, Fig. 15b. Dorsal sense organ of the palp tarsus reduced, slender and inconspicuous. Dorsal setae placed on rather conspicuous, sometimes pale colored, tubercles. *Male*—Color similar to female but usually without the reddish coloration. Penis with a sharply downturned end hook, Fig. 15d.

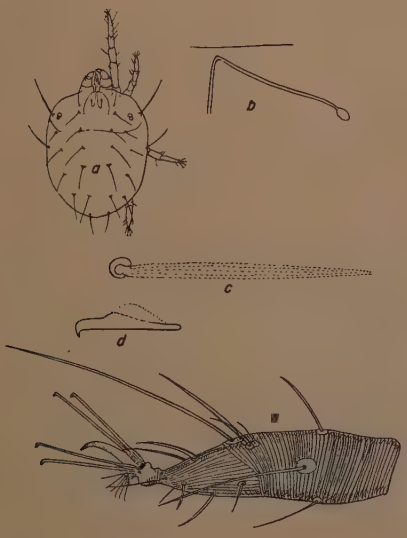

FIGURE 15. *Paratetranychus ilicis* McG. **a.** Adult female. **b.** Collar trachea. **c.** Dorsal spine. **d.** Penis. **e.** Tarsus I.

FIGURE 16. *Paratetranychus ununguis* Jacobi. **a.** Adult female color pattern. **b.** Adult female, dorsal view showing spines. **c.** Eyes. **d.** Collar tracheae. **e.** Egg in lateral view. **f.** Penis. **g.** Tarsus I.

Measurements: Adult female .33 to .38 by .26 mm.; male .23 to .28 mm. by .14 to .18 mm. in greatest width.

Host plants: Has been found on holly (*Ilex*), rose (*Rosa*), sweet pepperbush (*Clethra*), and *Camellia* in Connecticut.

Collections: New Haven, December 2, 1935; Portland, August 24, 1935; Westport, April 14, 1939; Norwalk, January 11, 1939, J. P. J.; Hamden, September 17, 1939; Cheshire, September 14, 1939, M.P.Z.

Rather conspicuous among red spiders because of its pinkish or sometimes reddish collar and darker abdomen. Differs from *pilosus*, which it resembles, in the collar trachea and male genitalia; from *bicolor* in the pinkish coloration. The egg lacks the conspicuously flattened area above, possessed by *bicolor*.

Infestations on Clethra cause the leaves to turn brown making the bushes conspicuous from a distance.

Paratetranychus ununguis Jacobi (Figures 12B, 16)

Jacobi, Naturw. Zeitschr. Land-u., Forst., p. 239. 1905.
McGregor, E. A., Proc. U. S. Nat. Mus., 56: p. 669. 1919.
Garman, P., Conn. Agr. Expt. Station, Bul. 247: pp. 340–342. 1923.

Eggs: Brown, depressed or flattened, striated on sides and with a central hair or seta.

Larva: Uniform flesh color.

Nymphs: Abdomen nearly black with middorsal pale streak; cephalothorax and legs flesh color.

Adults: *Female*—Abdomen dark green, nearly black in some individuals, with a middorsal pale streak, Fig. 16a. Cephalothorax and legs flesh color, eye spots conspicuous. Collar tracheae with elongate end chamber, somewhat elliptical, sometimes enlarged to ovoid or spherical. Tarsus of leg I with duplex setae closely approximate. Tarsal claw long, almost as long as the tenent hairs; appendiculate setae almost at base of claw. Dorsal setae slender, not set on tubercles. *Male*—Color similar to the female. Penis gradually curved with a small, rounded basilar lobe.

Measurements: Adult female .38 to .42 mm. by .24 to .27 mm. at widest portion; male .28 to .35 mm. by .15 mm.; egg diameter in dorsal view .15 mm.

Host plants: Found on spruce (*Picea*), hemlock (*Tsuga*), causing the needles to turn brown or yellow and drop off; also infests arborvitae and pine. More severe in general on recent transplants but often abundant on well established trees.

Localities: Abundant throughout the State, known as the "spruce mite".

Genus **Tetranychus** Dufour

This genus is represented in Connecticut by at least six species. The empodial apparatus, without definite claw, is divided into four or six divisions. Those provided with six are placed in Epitetranychus by various authors. If this is accepted it would mean that many of our American species would be placed in the genus Epitetranychus since nearly all have the empodium six cleft. However, it would seem to confuse matters too much to use the name here because of the long standing and very general use of the name Tetranychus.

The collar tracheae of the genus are always hooked in our species and sometimes complex.

Eggs of this genus are frequently spherical, practically always white or pale yellow in color and often translucent.

Reference: McGregor, E. A., Proc. U. S. Nat. Mus., **56**: pp. 649-663. 1919.

Key to Species

1. Duplex setae of tarsus I well separated 2
   Duplex setae of tarsus I approximate 3
2. Adult females uniform red; no setae on tarsus of leg I proximad of duplex setae, Fig. 19e. Penis of male without conspicuous knob at caudal end ..... **ludeni p.** 83
   Adult females variable, more often pale with two darker spots, one on each side. Several setae on tarsus of leg I proximad of duplex setae, Fig. 18e..... **bimaculatus p.** 81
3. Collar tracheae complex (hook composed either of a loop or several arms). Tarsi of leg I suddenly constricted beyond the duplex setae 4
   Collar trachea simple. Tarsi of leg I not suddenly constricted beyond the duplex setae 5
4. Tarsal empodium consisting of two thick claws and a number of small setae. Penis of male with a simple point..... **populi p.** 85
   Tarsal empodium consisting entirely of slender setae. Penis of male hooked and barbed ..... **ellipticus p.** 83
5. Claw of palp tibia not reaching beyond the dorsal sense organ. Penis of male long, slender, sinuate..... **willamettei p.** 85
   Claw of palp tibia reaching beyond the dorsal sense organ. Penis of male with a sharp downturned hook at tip..... **pallidus p.** 86

FIGURE 17. **A.** *Tetranychus pallidus* n. sp. **B.** *Bryobia praetiosa* Koch. **C.** *Tetranychus bimaculatus* Harvey.

Tetranychus bimaculatus Harvey (Figures 17C, 18)

Harvey, F. L., Ann. Rept. Maine Agr. Expt. Station, pp. 133–146, Pl. III, 1892 (1893).
McGregor, E. A., Proc. U. S. Nat. Mus., **56**: pp. 654–657. 1919.
Ewing, H. E. (*T. telarius*), Oregon Agr. Coll., Bul. **121**. 1914.

Eggs: Pearl-like, white or transparent, without dorsal striation or seta; spherical in shape.

Larvae and **nymphs:** Mostly pale with two darker spots on the dorsum.

Adults: *Female*—Variable from pale with two to six darker spots above to purplish red and obscure darker areas on sides. Tarsi with six appendiculate setae, no claw; duplex setae well separated and the longer setae of the two groups about equal in length; a number of lateral setae proximad of the proximal pair. Collar tracheae hooked and segmented (Fig. 18b); palp tarsus of usual form and setal pattern. Dorsal setae slender, longer than the intervals between. *Male*—Mostly similar to the two-spotted female, paler in color with a darker spot on either side. Penis hooked and barbed (Fig. 18c).

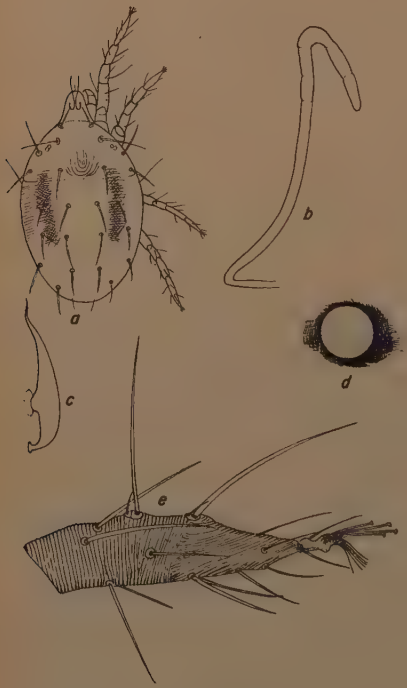

FIGURE 18. *Tetranychus bimaculatus* Harvey. **a.** Dorsal view of female. **b.** Collar trachea. **c.** Penis. **d.** Egg, dorsal view. **e.** Tarsus I.

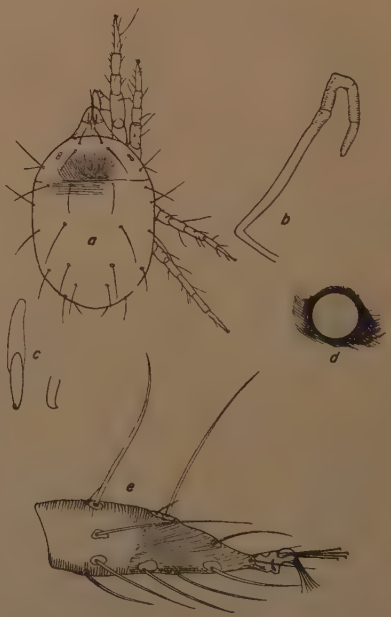

Figure 19. *Tetranychus ludeni* Zacher. **a.** Adult female dorsal view. **b.** Collar trachea. **c.** Penis. **d.** Egg. **e.** Tarsus I.

Measurements: Adult female length from tip of abdomen to front of cephalothorax .42 to .51 mm., greatest width .28 to .32 mm.; diameter of eggs .12 mm.

Hosts: This species has been found on a large number of plants and may be expected to turn up under suitable conditions on almost any cultivated species with the possible exception of conifers. It has been found

throughout the State. It causes severe loss in greenhouses, especially to such crops as cucumbers, roses, and many others. The tarsal structure of the female and the shape of the penis distinguish it from its nearest relative, *T. ludeni*. The separation of the duplex setae and structure of the collar tracheae easily distinguish it from other representatives in Connecticut.

This is the common "red spider" of the eastern United States.

Tetranychus ludeni Zacher (Figure 19)

Zacher, F., Mitt. Kaiserl. Biol. Aust. F. Land-und Forst, Heft 9. 1910.
McGregor, E. A., Proc. U. S. Nat. Mus., 56: p. 653. 1919.

Eggs: Color pearl-like, without definite color; nearly white; no striation or dorsal seta; spherical in shape.

Larvae: Indistinguishable from *bimaculatus* and similar to the nymphs in color—i.e., pale with a darker spot on each side.

Nymphs: Indistinguishable from *bimaculatus*, being largely pale flesh color with a darker spot on each side of the abdomen. Eye spots conspicuous.

Adults: *Female*—Uniform dark red; legs brownish. Tarsi (Fig. 19e) with usual form, the duplex setae of tarsus I well separated and the tarsi without lateral setae proximad of the proximal one; longer setae of the two duplex pairs about equal in length. Collar tracheae (Fig. 19b) hooked; palp tarsus of usual form. Dorsal setae of abdomen longer than the intervals between. *Male*—Penis with a curved, rather blunt point not expanded at tip as in *bimaculatus*, Fig. 19c. Color pale with conspicuous eye spots, the abdomen slightly darker just behind the eyes.

The main difference between this species and *bimaculatus* rests in the penis of the male and the tarsus of leg I which has lateral setae not or only slightly proximad of the proximal duplex pair. In addition, the distance between the two duplex setae is frequently much greater than the distance between the proximal pair and the base. The adult female is invariably dark red on all host plants from which we have taken it.

Measurements: Adult female .42 to .48 mm. by .27 to .31 mm.; male .30 by .15 mm.; eggs .13 to .14 mm.

Hosts: Found on *Salvia*, beans (*Phaseolus*), and *Ageratum* under hothouse conditions; probably occurs on a wide variety of plants. This species is without doubt more prevalent than realized, being confused with *bimaculatus* which varies in color from nearly white to blood red on different host plants. Pale females of this species have not been seen.

Tetranychus ellipticus n. sp. (Figure 20)

Eggs: Lozenge-shaped in profile, circular in dorsal view; slightly depressed and striated above but without central papilla; pearl-like, often with a yellowish tinge.

Nymphs and **larvae:** Similar in color to the adult female.

Adults: *Female*—Flesh color to greenish with obscure dark spots along sides behind the red colored eyes. Body elliptical, little narrowed at rear;

conspicuously depressed; middorsum with short feathered setae shorter than the intervals between. Collar tracheae peculiarly expanded at tip (Fig. 20h), often much more complicated than shown. Tip of tarsi with two hairy setae just proximad of the claw; duplex setae approximate on tarsus I; tip of tarsus I suddenly constricted, as shown in Fig. 20a, b. Palp tarsus without distinguishing features except that the claw is large and heavy-set and the terminal finger is small and slender. *Male*—Flesh colored to orange with conspicuous red eye spots and dark spots in the dorsum, as in the female. Legs conspicuously longer than those of the female; the first pair equal the total body length. Penis barbed as shown in Fig. 20f, slender, without dorsal projection on the basilar lobe.

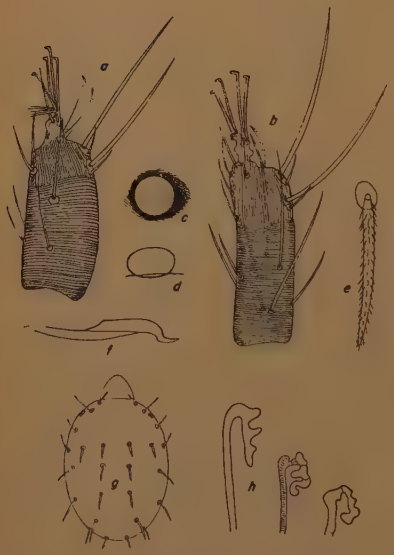

FIGURE 20. *Tetranychus ellipticus* n. sp. **a.** Tarsus I of adult female. **b.** Tarsus I of male. **c.** Egg. **d.** Same in lateral profile. **e.** Dorsal seta greatly enlarged. **f.** Penis. **g.** Adult female abdomen and cephalothorax. **h.** Tip of collar tracheae.

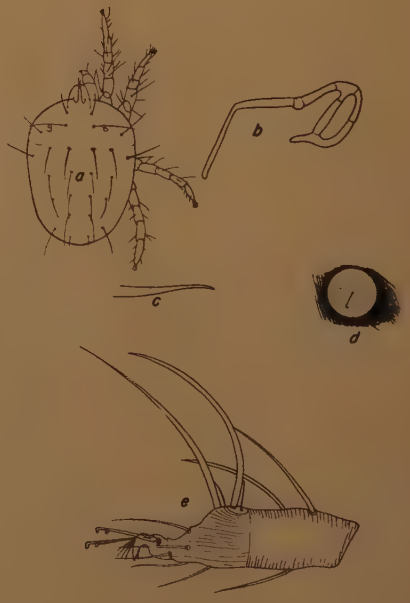

FIGURE 21. *Tetranychus populi* Koch. **a.** Adult female in dorsal view. **b.** Typical collar trachea. **c.** Tip of penis. **d.** Egg in dorsal view. **e.** Tarsus I.

Measurements: Female .36 to .39 mm. by .26 to .27 mm.; eggs .11 to .12 mm. in transverse diameter.

Hosts: So far this species has been found only on honey locust (*Gleditsia triacanthos*).

Localities and dates of collections: New Haven, August 27, 1931, P.G.; September 18, 1933, W.E.B.; August 28, 1934, P.G.; August 8, 1935, P.G.; August 10, 1939, P.G.; Glastonbury, August 11, 1939, P.G.

Types: Deposited in collection of the Connecticut Agricultural Experiment Station, New Haven, Conn.

Tetranychus populi Koch (Figure 21)

Koch, C. L., Deutschlands Crustaceen, Myriapoden u. Arachniden, 1835–1844. Description in 1838.
Garman, P., Conn. Agr. Expt. Station, Bul. 247: p. 339. 1923.

Eggs: Circular in dorsal view, white, pearl-like, translucent and with a central papilla above, as long or longer than the height of the egg.

Adults: *Female*—Pale white or yellowish species. Tarsi with long duplex setae and suddenly constricted beyond the distal pair; tarsus I with two heavy empodial claws and two pairs of slender hairs; collar tracheae complex at the hooked end, somewhat variable and often as figured (Fig. 21b). Palp tarsus with a heavy claw, reaching the base of the terminal finger. Dorsal setae long, inconspicuously feathered, and those on the middorsum reaching well beyond the base of those immediately behind. *Male*—Color similar to female. Penis with a long, slender tip, slightly curved, Fig. 21c.

Measurements: Female .36 mm. by .18 to .21 mm. at the greatest width; male .24 to .27 mm. by .15 mm.; egg .11 to .12 mm.

Host plants: Collected from poplar (*Populus*) and willow (*Salix*).

Collections: Hamden, August 27, 1922; August 26, 1939; Southington, September 3, 1939.

A fairly common species in this vicinity, the injury frequently showing as pale streaks along the midribs of the leaves.

Tetranychus willamettei McGregor (Figure 22)

McGregor, E. A., Proc. U. S. Nat. Mus., 51: p. 586, 1917; 56: pp. 660-61, 1919.

Eggs: Summer eggs pale flesh color, or slightly yellow.

Larvae and **nymphs:** Similar in general color to adults.

Adults: *Female*—Flesh color to nearly white with conspicuous red eye spots and a few irregular darker spots along sides at rear; legs and sometimes abdomen yellowish in appearance. Tarsus I very short, duplex setae almost in contact at base. Palp tibia with short claw, Fig. 22h, tarsus with slender terminal finger, a dorsal spatulate sense organ and two heavy setae above terminal finger and one below. Dorsum with dorsal setae distinctly feathered under high magnification (Fig. 22a), much longer than the intervals between. Collar tracheae with expanded chamber as in Fig. 22c, somewhat variable in shape, but not with the long hook of *bimaculatus* and others of the genus, sometimes appearing to lack the hook and expand in manner similar to *Paratetranychus* species. *Male*—Similar in color to the female. Penis long, slender, curved as shown in Fig. 22f. Tarsus I with divided claw.

Measurements: Adult female .24 to .30 mm. long by .13 to .15 mm. at widest portion; male .21 to .27 mm. by .12 mm.; egg .08 mm.

Host plants: Found on oak and elm leaves, causing small rusty patches.

Collections: Bantam, Conn., June 3, 1930, on oak; Hamden, Conn., July 23, 1939, on elm.

Tetranychus pallidus n. sp. (Figure 23)

Eggs: White to yellowish; spherical, translucent, without dorsal striations.

Larvae and **nymphs:** White to yellowish, with obscure darker spots along sides.

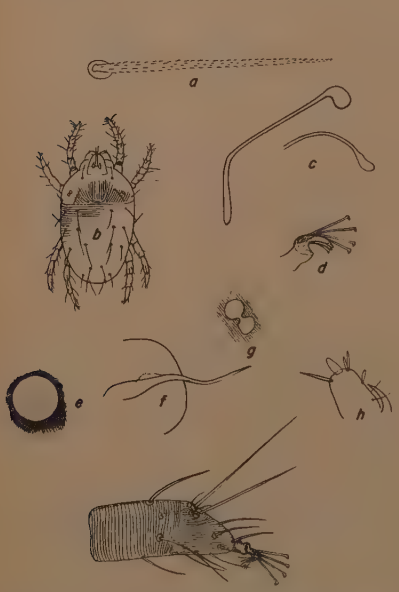

FIGURE 22. *Tetranychus willamettei* McG. **a.** Dorsal seta. **b.** Adult female. **c.** Collar tracheae. **d.** Male tarsal claws. **e.** Egg. **f.** Penis. **g.** Eyes. **h.** Palp tarsus. **i.** Tarsus I.

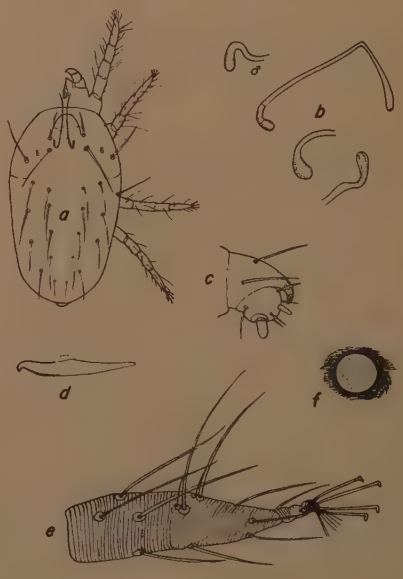

FIGURE 23. *Tetranychus pallidus* n. sp. **a.** Adult female. **b.** Collar tracheae. **c.** Palp tarsus. **d.** Penis. **e.** Tarsus I. **f.** Egg.

Adults: *Female*—Elongate, small, pale yellow to almost white and somewhat translucent. Tarsi slender, not suddenly constricted, with four appendiculate spurs, the duplex setae separated about the width of the basal discs; long seta of the distal pair longer than the long seta of the proximal pair. Collar tracheae slender, suddenly enlarged at tip and hooked, two terminal chambers visible in some, Fig. 23b; claw of palp tibia extending beyond the dorsal sense organ. Dorsal setae of the usual number and arrangement, inconspicuously feathered and not set on tubercles; middorsal setae longer than the interval between their bases. *Male*—Similar in color to the female and nymphs. Penis, Fig. 23d, with a short hook at tip, turned downwards.

Measurements: Adult female .27 to .30 mm. by .15 to .17 mm. at widest portion; male .21 mm. by .11 to .12 mm.; egg .10 to .11 mm.

Hosts: Found August 24, 1939, abundantly on the leaves of a beech tree, causing the foliage to turn brown; also September 9, 1924, in Hamden on the same host; August 26, 1939, unknown host; Southington, September 3, 1939, on beech.

Types: In collection of the Connecticut Agricultural Experiment Station.

This species appears to be nearer *Epitetranychus fagi* Zacher (Zool. Anz., **97**, 1932) than anything that we have. Because of its small size, hooked collar trachea and structure of the male genitalia which has a much shorter end hook, it is described as new.

PLANTS ON WHICH MITES HAVE BEEN FOUND

THE following abbreviated host index is not intended to give a complete picture of the great variety of plants on which red spiders are found. It is well known, for example, that *Tetranychus bimaculatus* may inhabit almost any deciduous plant. It is not known to occur in Connecticut on conifers, but to list fully the plants that it does infest would require more space than appears desirable to devote to it. The records are taken mainly from specimens in our collection. Those marked with an asterisk have been found in greenhouses.

Partial Host Index of Species Found in Connecticut

Acer (maple)..... *Paratetranychus bicolor*
Ageratum..... *Tetranychus ludeni**
Alnus (alder)..... *Tetranychus pallidus*
Amygdalus (peach)..... *Paratetranychus pilosus*
Arborvitae..... *Paratetranychus ununguis*
Buxus (Boxwood)..... *Neotetranychus buxi*
Camellia..... *Paratetranychus ilicis**
Carya (hickory)..... *Paratetranychus bicolor*
Castanea (chestnut)..... *Paratetranychus bicolor*
Chrysanthemum..... *Tetranychus bimaculatus**
Clethra (sweet pepperbush). *Paratetranychus ilicis*
Cucurbitaceae (squash, cucumber, etc.)..... *Tetranychus bimaculatus**
Eupatorium (Joe-pye-weed) *Tenuipalpus bioculatus*
Fagus (beech)..... *Tetranychus pallidus*
Fragaria (strawberry)..... *Tetranychus bimaculatus*
Geranium..... *Tetranychus bimaculatus*
Gleditsia (honey locust)..... *Tetranychus ellipticus*
Gramineae (grasses)..... *Tetranychus bimaculatus*
Ilex (holly)..... *Paratetranychus ilicis*
Juniper..... *Paratetranychus ununguis*
Oxalis..... *Tetranychina harti*
Phaseolus (bean)..... *Tetranychus bimaculatus**, *T. ludeni*
Phlox..... *Tetranychus bimaculatus*
Picea (spruce)..... *Paratetranychus ununguis*
Pinus (pine)..... *Paratetranychus ununguis*
Prunus (plum)..... *Paratetranychus pilosus*
Pyrus (apple, pear)..... *Paratetranychus pilosus, Tetranychus bimaculatus*
Quercus (oak)..... *Paratetranychus bicolor, Tetranychus willamettei*
Rosa (rose)..... *Paratetranychus pilosus, P. ilicis**, *Tetranychus bimaculatus**
Rubus (raspberry)..... *Tetranychus bimaculatus*
Salix (willow)..... *Schizotetranychus schizopus, Tetranychus populi*
Salvia..... *Tetranychus ludeni**
Sambucus (elderberry)..... *Tenuipalpus bioculatus, Tetranychus bimaculatus*
Sorbus (mountain ash)..... *Paratetranychus pilosus*
Spirea..... *Schizotetranychus spireafolia*
Tilia (linden)..... *Tetranychus bimaculatus*
Tsuga (hemlock)..... *Paratetranychus ununguis*
Ulmus (elm)..... *Paratetranychus pilosus, Tetranychus bimaculatus, T. willamettei*
Viola (violet)..... *Tetranychus bimaculatus**
Zea (corn)..... *Tetranychus bimaculatus**